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(54) **APPARATUS AND METHOD FOR CONFIGURING PERSONAL NETWORK USING PN ROUTING TABLE**

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H04W 4/20	(2009.01)
H04L 12/66	(2006.01)
H04L 29/06	(2006.01)
H04L 12/741	(2013.01)

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(58) **Field of Classification Search**

USPC 370/351, 389, 400, 401

See application file for complete search history.

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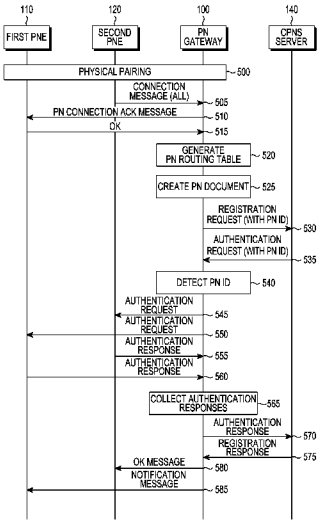
Primary Examiner — Michael J Moore, Jr.

(74) *Attorney, Agent, or Firm* — The Farrell Law Firm, P.C.

(57) **ABSTRACT**

A method and an apparatus are provided for configuring a Personal Network (PN). A connection request message is received from a Personal Network Entity (PNE) at the PN gateway. A registration request message for a PN, to which the PNE belongs, is transmitted from the PN gateway to a server located in a Wide Area Network (WAN). An authentication request message including ID information of the PN is received at the PN gateway from the server. The authentication request message is forwarded from the PN gateway to one or more PNEs mapped to the ID information of the PN, with reference to a PN routing table in which information about the one or more PNEs is mapped to the ID information of the PN. The one or more PNEs receive a service from the server through the PN gateway.

22 Claims, 5 Drawing Sheets



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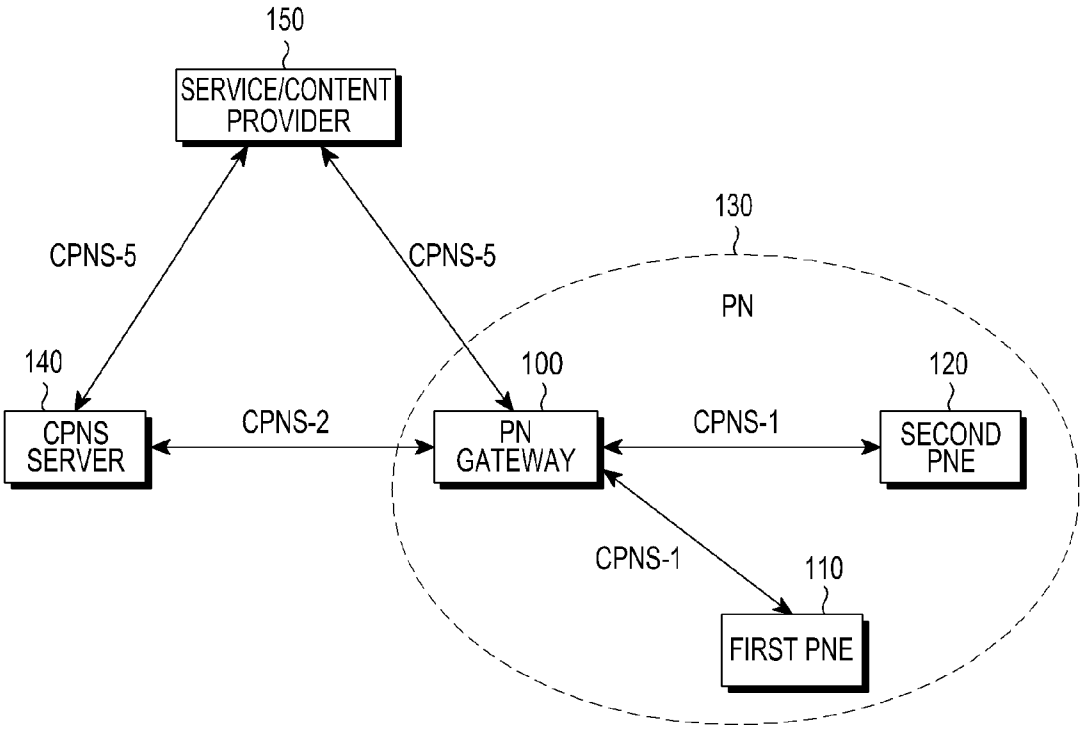
150
SERVICE/CONTENT PROVIDER
CPNS-5
CPNS-5
130
PN
140
CPNS SERVER
CPNS-2
100
PN GATEWAY
CPNS-1
120
SECOND PNE
CPNS-1
110
FIRST PNE

FIG.1

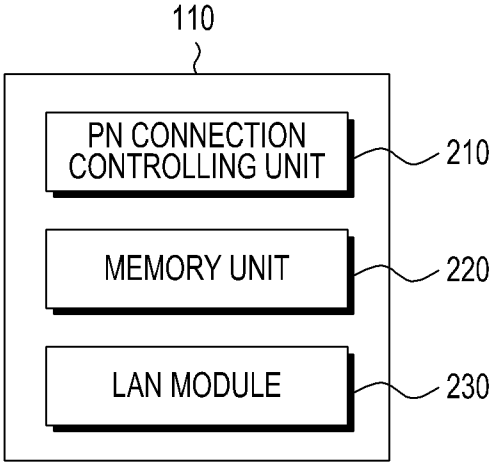
110
PN CONNECTION CONTROLLING UNIT
210
MEMORY UNIT
220
LAN MODULE
230

FIG.2

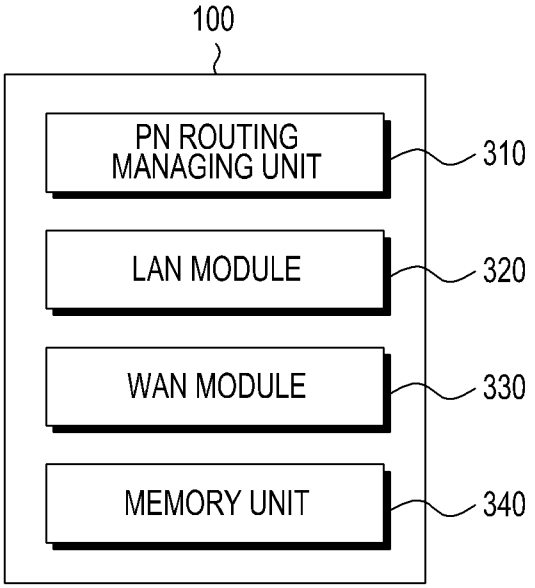
100
PN ROUTING MANAGING UNIT
310
LAN MODULE
320
WAN MODULE
330
MEMORY UNIT
340

FIG.3

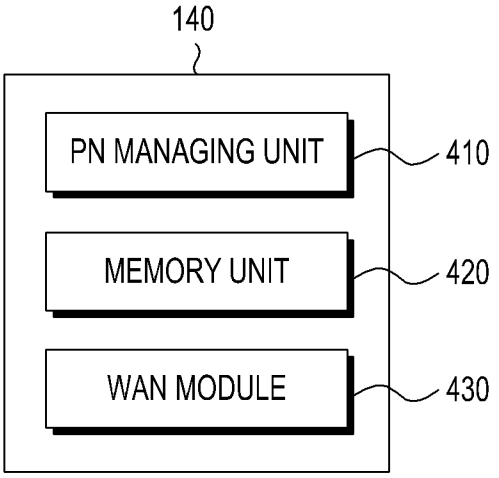

FIG.4

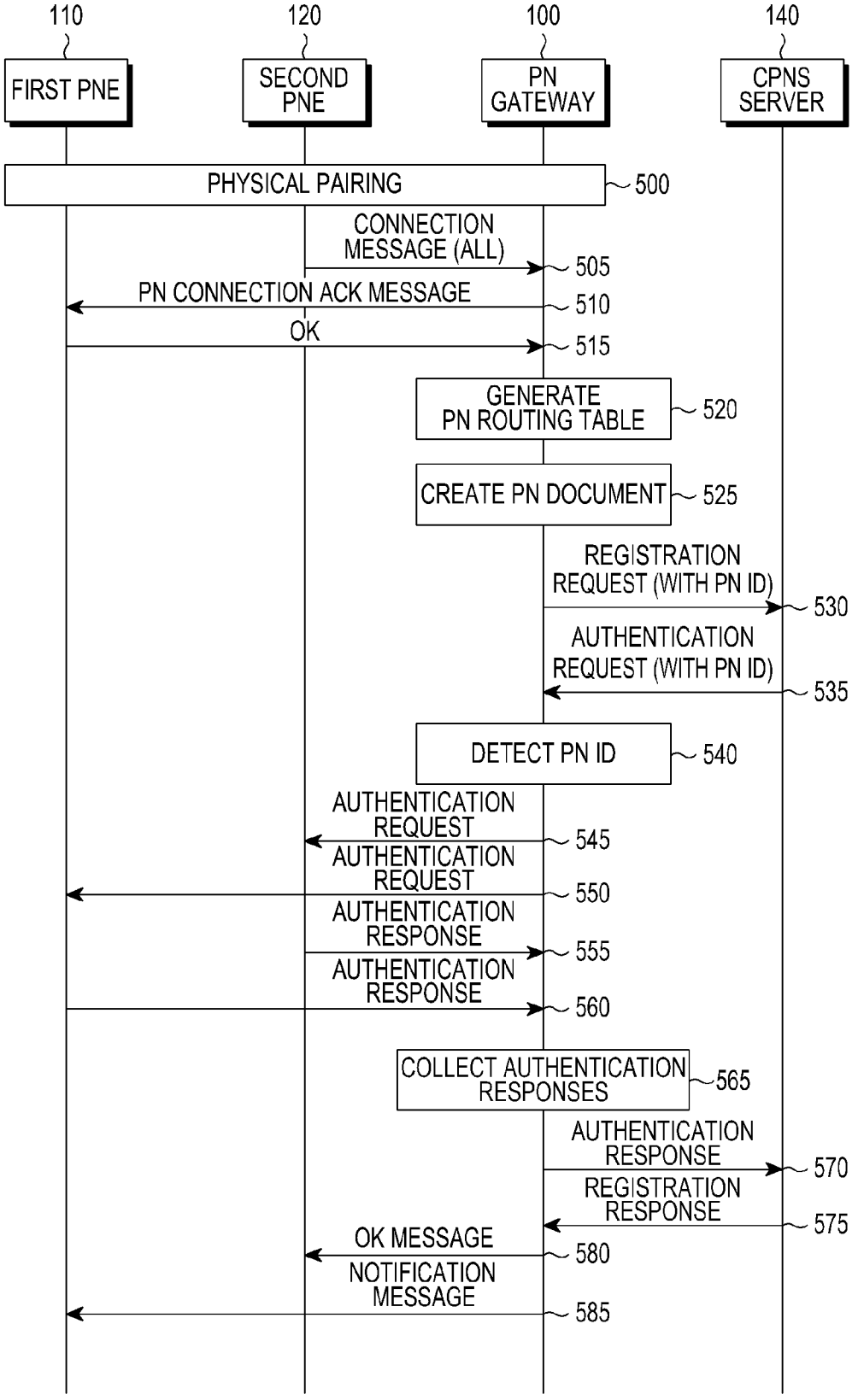
110
120
100
140
FIRST PNE
SECOND PNE
PN GATEWAY
CPNS SERVER
PHYSICAL PAIRING
500
CONNECTION MESSAGE (ALL)
505
PN CONNECTION ACK MESSAGE
510
OK
515
GENERATE PN ROUTING TABLE
520
CREATE PN DOCUMENT
525
REGISTRATION REQUEST (WITH PN ID)
530
AUTHENTICATION REQUEST (WITH PN ID)
535
DETECT PN ID
540
AUTHENTICATION REQUEST
545
AUTHENTICATION REQUEST
550
AUTHENTICATION RESPONSE
555
AUTHENTICATION RESPONSE
560
COLLECT AUTHENTICATION RESPONSES
565
AUTHENTICATION RESPONSE
570
REGISTRATION RESPONSE
575
OK MESSAGE
580
NOTIFICATION MESSAGE
585

FIG.5

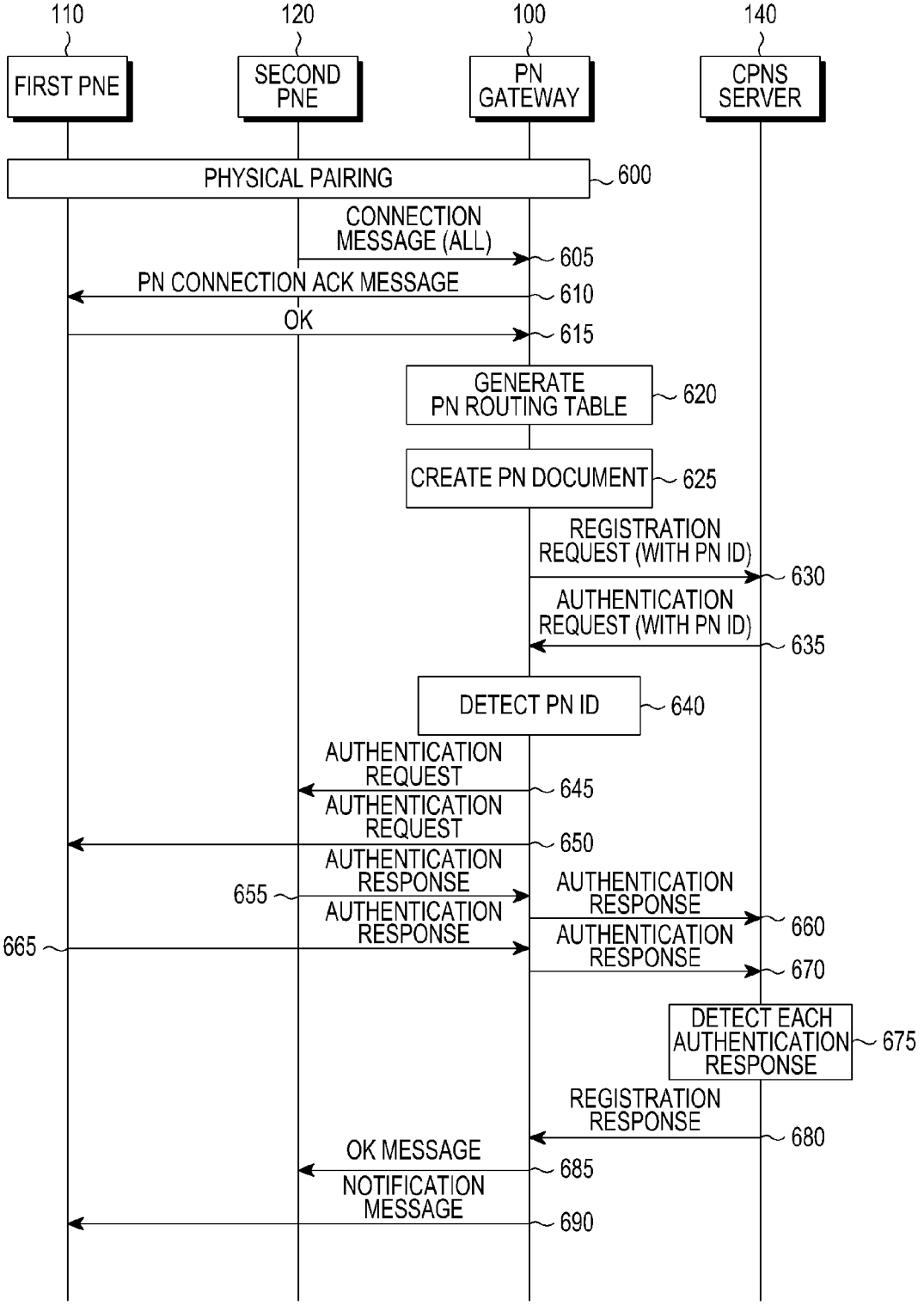
110
120
100
140
FIRST PNE
SECOND PNE
PN GATEWAY
CPNS SERVER
PHYSICAL PAIRING
600
CONNECTION MESSAGE (ALL)
605
PN CONNECTION ACK MESSAGE
610
OK
615
GENERATE PN ROUTING TABLE
620
CREATE PN DOCUMENT
625
REGISTRATION REQUEST (WITH PN ID)
630
AUTHENTICATION REQUEST (WITH PN ID)
635
DETECT PN ID
640
AUTHENTICATION REQUEST
645
AUTHENTICATION REQUEST
650
AUTHENTICATION RESPONSE
655
AUTHENTICATION RESPONSE
660
AUTHENTICATION RESPONSE
665
AUTHENTICATION RESPONSE
670
DETECT EACH AUTHENTICATION RESPONSE
675
REGISTRATION RESPONSE
680
OK MESSAGE
685
NOTIFICATION MESSAGE
690

FIG.6

APPARATUS AND METHOD FOR CONFIGURING PERSONAL NETWORK USING PN ROUTING TABLE

PRIORITY

This application claims priority under 35 U.S.C. §119(a) to a Korean Patent Application filed in the Korean Intellectual Property Office on Jun. 18, 2010 and assigned Serial No. 10-2010-0057929, the entire disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a device capable of Local Area Network (LAN) communication, and more particularly, to an apparatus and a method that allows a LAN communication device to receive a service from a Wide Area Network (WAN) by using a communication function of a device capable of accessing the WAN.

2. Description of the Related Art

With the dramatic increase in the use of Consumer Electronics (CE) devices capable of LAN communication, users of CE devices have sought convenient content download methods. CE devices capable of LAN communication may include MP3 players, Portable Multimedia Players (PMPs), game consoles, and netbooks.

In general, a Personal Computer (PC) is used to search the Internet for and download contents that are playable in a CE device. When the CE device and the PC are connected by a dedicated cable, the CE device downloads the contents from the PC. This process enables the CE device to play the contents. Recently, Bluetooth has been used to share contents among devices, replacing the dedicated cable.

However, CE devices still have limitations in directly accessing a WAN. For example, in order to access the WAN, some CE devices use WiFi to connect to the Internet within the coverage of an Access Point (AP). Converged Personal Network Service (CPNS) has been proposed to allow CE devices to access the WAN through a gateway to receive a desired service, such as a content download service.

Regarding the CPNS, a Personal Network (PN) is configured to include a gateway communicating with a WAN and at least one CE device playing services and contents. The CE device accesses a service/content provider of the WAN through the gateway to receive desired services or contents. The gateway in the CPNS is called a PN gateway, and the CE device, connecting to the PN gateway by LAN communication and accessing the WAN through the PN gateway, is called a Personal Network Entity (PNE).

In a CPNS system, a plurality of PNEs connect to a PN gateway and access a CPNS server through the PN gateway. In this manner, the PN gateway configures a PN with the PNEs and operates as a relay between the CPNS server and the PNEs. However, the load of the PN gateway and the CPNS server in processing separate TX/RX messages increases as the number of PNEs connecting to the PN gateway increases.

In order to avoid this increase in load, in the process of configuring a PN through the PN gateway, the PN gateway compiles information about all the PNEs into a PN document, and the CPNS server performs authentication based on the PN document. However, a large load is applied to the PN gateway when the PN gateway parses a PN document at every authentication request of the CPNS server in a registration process, extracts address information of the PNEs, and performs a routing operation.

SUMMARY OF THE INVENTION

The present invention has been made to address at least the above problems and/or disadvantages and to provide at least the advantages described below. Accordingly, an aspect of the present invention provides an apparatus and method for configuring a PN, which can reduce the processing load of a PN gateway.

Another aspect of the present invention provides an apparatus and method for configuring a PN, which makes it possible to forward authentication request messages from a CPNS server to the corresponding PNEs without parsing the authentication request messages by a PN gateway.

According to one aspect of the present invention, a method is provided for configuring a PN by a PN gateway. A connection request message is received from a PNE at the PN gateway. A registration request message for a PN, to which the PNE belongs, is transmitted from the PN gateway to a server located in a WAN. An authentication request message including ID information of the PN is received at the PN gateway from the server. The authentication request message is forwarded from the PN gateway to one or more PNEs mapped to the ID information of the PN, with reference to a PN routing table in which information about the one or more PNEs is mapped to the ID information of the PN. The one or more PNEs receive a service from the server through the PN gateway.

According to another aspect of the present invention, a method is provided for configuring a PN by a server located in a WAN. A registration request message for the PN, to which one or more PNEs belong, is received at the server from the PN gateway. An authentication request message including ID information of the PN for authentication of the PN is transmitted from the server to the PN gateway. An authentication response message is received from the PN gateway that forwards the authentication request message from the one or more PNEs mapped to the ID information of the PN. The one or more PNEs are authenticated by using the received authentication response message. The one or more PNEs receive a service from the server through the PN gateway.

According to an additional aspect of the present invention, a PN gateway is provided for configuring a PN. The PN gateway includes a LAN module for communicating with one or more PNEs, a WAN module for communicating with a server located in a WAN, and a memory unit for storing a PN routing table in which information about the one or more PNEs is mapped to ID information of the PN. The PN gateway also includes a PN routing managing unit for transmitting a registration request message for the PN to the server upon receiving a connection request message form a PNE. The PN gateway also forwards an authentication request message to the one or more PNEs mapped to the ID information of the PN, with reference to the PN routing table, upon receiving the authentication request message including the ID information of the PN from the server. The one or more PNEs receive a service from the server through the PN gateway.

According to a further aspect of the present invention, a server located in a WAN is provided for configuring a PN. The server includes a WAN module for communicating with a PN gateway. The server also includes a PN managing unit for transmitting an authentication request message including ID information of a PN for authentication of the PN upon receiving a registration request message for the PN, to which one or

more PNEs below, from the PN gateway. The PN managing unit also authenticates the one or more PNEs by using an authentication response message upon receiving the authentication response message from the PN gateway, which forwards the authentication request message to the one or more PNEs mapped to the ID information of the PN. The one or more PNEs receive a service from the server through the PN gateway.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and advantages of the present invention will be more apparent from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a block diagram of a CPNS system, according to an embodiment of the present invention;

FIG. **2** is a block diagram of a PNE, according to an embodiment of the present invention;

FIG. **3** is a block diagram of a PN gateway, according to an embodiment of the present invention;

FIG. **4** is a block diagram of a CPNS server, according to an embodiment of the present invention;

FIG. **5** is a flow diagram illustrating a PN configuration/registration process using a PN routing table, according to a first embodiment of the present invention; and

FIG. **6** is a flow diagram illustrating a PN configuration/registration process using a PN routing table, according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE PRESENT INVENTION

Embodiments of the present invention are described in detail below in detail with reference to the accompanying drawings. The present invention may be embodied in different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present invention to those skilled in the art. The same or similar components may be designated by the same or similar reference numerals although they are illustrated in different drawings. Detailed descriptions of constructions or processes known in art may be omitted to avoid obscuring the subject matter of the present invention.

For the sake of convenience, terms regarding names of entities defined in CPNS of Open Mobile Alliance (OMA), which is an organization for standardization of applications of mobile terminals, are used to describe the present invention. However, it should be noted that the scope of the present invention is not limited by such terms, and the present invention may also be applicable to systems with similar technical backgrounds.

The present invention provides a method for using a pre-generated PN routing table to reduce the processing load of a PN gateway when the PN gateway receives an authentication request for PNEs. The PN gateway obtains information about one or more PNEs for PN configuration to generate the PN routing table. In the PN routing table, information about one or more PNEs is mapped to IDentification (ID) information of the PN. When receiving an authentication request message for the PNEs corresponding to the PN ID information from a CPNS server, the PN gateway detects the target PNEs by the PN routing table and forwards the authentication request message to the PNEs. Accordingly, the PN gateway need not parse the PN document of the message received from the CPNS server, thus significantly reducing the processing load.

An example of the CPNS system with the above function is described in detail below with reference to FIG. **1**.

FIG. **1** is a block diagram of a CPNS system, according to an embodiment of the present invention.

Referring to FIG. **1**, a CPNS system, according to an embodiment of the present invention, includes one or more PNEs (e.g., a first PNE **110** and a second PNE **120**), a PN gateway **100**, a CPNS server **140**, and a service/content provider **150** serving as an application server.

The service/content provider **150** is a server that is located in a WAN to provide various services and contents.

The first and second PNEs **110** and **120** are devices that directly receive services and contents. Examples of the PNEs include MP3 players and PMPs. The first and second PNEs **110** and **120** receive contents from the service/content provider **150** and play the contents to provide services to the users. The first and second PNEs **110** and **120** are capable of LAN communication with an adjacent device (i.e., another PNE) because they include a LAN module. However, the first and second PNEs **110** and **120** cannot directly access a service provider because they do not have a WAN module. Examples of the WAN include the Internet and mobile phone networks. The PNE is also referred to as a PN device.

The first and second PNEs **110** and **120** configure a PN **130** with the PN gateway **100** by LAN communication. The configuring of the PN **130** includes detecting the support/non-support of a PN service (e.g., a CPNS) between the PN gateway **100** and the first and second PNEs **110** and **120**, detecting a function between devices, and configuring a network for an application for providing a CPNS.

The PN **130** may include the PN gateway **100** and the first and second PNEs **110** and **120** connected to the PN gateway **100**. Through the PN **130**, the first and second PNEs **110** and **120** can use a function of the PN gateway **100** capable of accessing a WAN. Thus, the first and second PNEs **110** and **120** can access the CPNS server **140** through the PN gateway **100**, and can use a CPNS to receive contents from the service/content provider **150**.

The PN gateway **100** is a device that is capable of accessing the CPNS server **140** located in a WAN (i.e., a service provider network). The PN gateway **100** configures the PN **130** with the first and second PNEs **110** and **120**, and relays the transmission of CPNS system messages, services, or contents between the CPNS server **140** and the first and second PNEs **110** and **120**. Specifically, when receiving a service request from the first and second PNEs **110** and **120** included in the PN **130**, the PN gateway **100** relays the service request to the CPNS server **140**. Also, when receiving a requested service from the service/content provider **150**, the PN gateway **100** transmits the requested service to the first and second PNEs **110** and **120**.

When completing a physical pairing with the first and second PNEs **110** and **120** and receiving a CPNS connection request from the first and second PNEs **110** and **120**, the PN gateway **100** creates a document for the PN **130** including the PN gateway **100** and the first and second PNEs **110** and **120** connected to the PN gateway **100**. A registration request for the PN **130** is transmitted to the CPNS server **140**.

The PN gateway **100** collects information about the first and second PNEs **110** and **120** having requested a connection with the PN gateway **100**, generates a PN routing table, and stores the PN routing table. In the PN routing table, information about the first and second PNEs **110** and **120** is mapped to ID information of the PN **130** that includes the first and second PNEs **110** and **120**. When receiving an authentication

request for PNEs of a PN from the CPNS server **140**, the PN gateway **100** uses the PN routing table to route the authentication request to the PNEs. In this manner, the PN gateway **100** stores or manages information about each PNE to facilitate the message forwarding from the CPNS server **140**, thus reducing the message processing load.

In addition, the PN gateway **100** connects its own PN to another PN to exchange contents in a Peer-To-Peer (PTP) scenario. Examples of the PN gateway **100** include mobile phones, PDAs, and set-top boxes.

The CPNS server **140** registers and manages the PN gateway **100**, the first and second PNEs **110** and **120**, and the PN **130**. The CPNS server **140** processes a service/content request received from the first and second PNEs **110** and **120** through the PN gateway **100**. If the service/content corresponding to the service/content request is able to be provided by the CPNS server **140**, the CPNS server **140** provides the requested service/content to the first and second PNEs **110** and **120** through the PN gateway **100**. If the service/content corresponding to the service/content request is not able to be provided by the CPNS server **140**, the CPNS server **140** transmits the service/content request to the service/content provider **150** to provide the requested service/content to the first and second PNEs **110** and **120** through the PN gateway **100**.

The detailed operations of the first and second PNEs **110** and **120**, the PN gateway **100** and the CPNS server **140** of the CPNS system are described in detail below with reference to FIGS. **2** to **4**.

FIG. **2** is a block diagram of the first PNE **110**, according to an embodiment of the present invention. The second PNE **120** may have the same configuration as the first PNE **110**. For the sake of convenience, a PN configuration process will be described in the context of the first PNE **110**.

Referring to FIG. **2**, the first PNE **110** includes a PN connection controlling unit **210**, a memory unit **220**, and a LAN module **230**.

The PN connection controlling unit **210** controls the operations of the first PNE **110** associated with PN configuration/de-configuration, and controls the operations associated with service/content request and reception through a configured PN. Accordingly, in order to configure a PN, the PN connection controlling unit **210** controls the LAN module **230** to perform a physical pairing with adjacent devices to establish a communication link.

The PN connection controlling unit **210** searches the physically-paired devices for the PN gateway **100**. When detecting the PN gateway **100**, the PN connection controlling unit **210** transmits a PN connection request message to the PN gateway **100**. Herein, the PN connection request message includes a PN connection type indicator and device information of the first PNE **110**.

The PN connection controlling unit **210** receives an authentication request message transmitted from the CPNS server **140** through the PN gateway **100** in response to the PN connection request message. The authentication request message carries a PN document and includes an authentication challenge field set by the CPNS server **140**. The authentication challenge field may include algorithm information and nonce value information, and the PN connection controlling unit **210** obtains a calculation result value for authentication on the basis of such information.

The PN connection controlling unit **210** creates the obtained calculation result value as a response to the authentication challenge field to change the PN document, and generates an authentication response message carrying the changed PN document. The PN connection controlling unit **210** transmits the authentication response message through the PN gateway **100** to the CPNS server **140**. Thereafter, when PN configuration/registration is completed, the PN connection controlling unit **210** receives a message notifying the completion of PN configuration/registration.

The memory unit **220** stores device information of the first PNE **110** and various program data necessary for PN configuration. The device information is information about the capability and functions of the first PNE **110**, which may be provided by the PNE manufacturer. The memory unit **220** also stores data received from the PN gateway **100** in response to a service/content request. Table 1 shows an example of the device information in the case where the first PNE **110** is a PMP.

TABLE 1

Device Capability Information

Parameter	Value
Device Type	Portable Media Player
Network Interface	Bluetooth
Model	PMP-YEPP T10
Device Address	002567Axxxxxx
Bandwidth	1 Mbps
Storage	2048 MB
I/O Interface	Display, Mic, Speaker
Video Codec	H.264
Audio Codec	AC3
Display Size	6 × 4 inch
Resolution	1024 × 768
Battery	30 W
. . .	. . .

The LAN module **230** performs LAN communication with the PN gateway **100**. Examples of the LAN module **230** include WiFi modules, Bluetooth modules, ZigBee modules, Infrared Data Association (IrDA) modules, and Visible Light Communication (VLC) modules. The LAN module **230** is used to perform a pairing operation, i.e., a connecting operation for data communication between the first PNE **110** and the PN gateway **100**.

FIG. **3** is a block diagram of the PN gateway **100**, according to an embodiment of the present invention.

Referring to FIG. **3**, the PN gateway **100** includes a PN routing managing unit **310**, a LAN module **320**, a WAN module **330**, and a memory unit **340**.

The LAN module **320** performs LAN communication with the first PNE **110**. Examples of the LAN module **320** include WiFi modules, Bluetooth modules, ZigBee modules, IrDA modules, and VLC modules.

The WAN module **330** communicates data and messages with the CPNS server **140**. Examples of the WAN module **330** include cellular modules and ATM modules.

The memory unit **340** stores various program data necessary for PN configuration. The memory unit **340** also stores a device list of PNEs included in the PN and device information of the PNEs. The device list and the device information may be managed on a PN-by-PN basis. The memory unit **340** also stores a PN routing table in which addresses among the device information of the PNEs are mapped to ID information of the PN (e.g., a PN ID). When receiving an authentication request for the PNEs corresponding to the PN ID from the CPNS server **140**, the PN gateway **100** uses the PN routing table to route the authentication request to the addresses of the PNEs.

The PN ID may be a unique ID of the PN gateway, or may be a value obtained by changing the unique ID by a predetermined algorithm. Also, the PN ID may be allocated by the CPNS server **140**.

Table 2 shows an example of the PN routing table.

TABLE 2

Personal Network #1	
PNE 1	Address (IP: xxx.xxx.xxx.xxx)
PNE 2	Address (Bluetooth: 00233Axxxxxx)

When receiving a PN connection request message from the first PNE **110**, the PN routing managing unit **310** detects a PN connection type indicator and device information of the first PNE **110** that are included in the PN connection request message. On the basis of the PN connection type indicator, the PN routing managing unit **310** determines whether the PN connection request from the first PNE **110** is a 1:1 connection request or a connection request for all the PNEs adjacent to the PN gateway **100**.

If the PN connection type indicator is set to 'ALL', the PN routing managing unit **310** performs a pairing/discovering operation on all adjacent PNEs to perform an operation for PN configuration with the detected PNE. The PN routing managing unit **310** transmits a connection request message to the detected PNE. The connection request message from the first PNE **110** is a message that includes device information of the first PNE **100** and is transmitted to the PN gateway **100**. The connection request message is a message that is referred to as 'PN Connection ASK' and is used by the PN gateway **100** to transmit a connection request to the PNE.

The connection request for all PNEs adjacent to the PN gateway **100** may be useful in providing an interactive game of the CPNS to several PNEs through one PN gateway **100**. This method does not require the PNEs to separately request PN configuration with the PN gateway **100**, thus reducing power consumption, such as network resources and device resources.

The PN routing managing unit **310** obtains an address from the device information of each of a response message for the connection request message to the detected PNE and the connection request message from the first PNE **110**. The PN routing managing unit **310** allocates PN ID information to a PN for the detected PNEs, generates a PN routing table in which the PN ID information is mapped to the addresses of the PNEs included in the PN, and stores the PN routing table in the memory unit **340**.

The PN routing managing unit **310** creates a PN document including information about a PN. In this manner, when configuring a PN, the PN routing managing unit **310** compiles information about all the PNEs of the PN into a PN document.

The PN document may include a list of devices in the PN, and the device list may include device information of each PNE. The PN document includes PN ID information. The PN routing managing unit **310** transmits a PN registration request message carrying the created PN document to the CPNS server **140**. The PN document may include only the device list except the device information of each PNE. Table 3 shows an example of the PN document generated by the PN gateway **100**.

TABLE 3

Personal Network #1 - Identity PN GW Info. PNE #1	
Parameter	Value
Device Info.	
Device Name	Portable Media Player
Network Interface	Bluetooth
Bandwidth	1 Mbps
Storage	2048 MB
I/O Interface	Display, Mic, Speaker
Video Codec	H.264
Audio Codec	AC3
Display Size	6 × 4 inch
Resolution	1024 × 768
Battery	30 W
...	...
Content Info.	
Music	Seo Tae-ji Album #8
Movie	Terminator #4
...	...
PNE #2	
PNE #3	
...	

The PN routing managing unit **310** receives an authentication request message transmitted from the CPNS server **140** in response to the PN registration request message. Because the CPNS server **140** requests authentication of the PNEs in the PN document, the PN routing managing unit **310** detects information about the PNEs in the PN document. According to an embodiment of the present invention, the PN routing managing unit **310** detects addresses of target PNEs by using the generated PN routing table, without parsing the PN document.

Specifically, the PN routing managing unit **310** detects PN ID information of an authentication request message. The PN routing managing unit **310** searches the PN routing table for the address of the PNE mapped to the detected PN ID information. The authentication request message carries the PN document changed by the CPNS server **140**, but the PN routing managing unit **310** only detects the PN ID information. Therefore, the PN routing managing unit **310** need not parse or unpack the PN document of the authentication request message in order to obtain the address information of each PNE. Thus, after searching the PN routing table to detect the address of the PNE to receive the authentication request message, the PN routing managing unit **310** forwards the authentication request message to the PNEs on the basis of the detected address of the PNE.

The PN routing managing unit **310** receives an authentication response message transmitted from each PNE in response to the authentication request message. According to an embodiment of the present invention, the PN routing managing unit **310** collects authentication response messages from the PNEs, generates an integrated authentication response message, and transmits the integrated authentication response message to the CPNS server **140**. In the integrated authentication response message, the PN documents in the authentication response messages from the PNEs are also combined into an integrated PN document. Herein, the PN routing managing unit **310** changes the PN documents from the PNEs to create the integrated PN document.

According to another embodiment of the present invention, whenever receiving an authentication response message from each of the PNEs, the PN routing managing unit **310** transmits the authentication response message to the CPNS server **140**. The CPNS server **140** authenticates the PNEs, creates an integrated PN document, and transmits an integrated registration response message carrying the integrated PN docu-

ment to the PN routing managing unit **310**. When receiving the integrated registration response message from the CPNS server **140**, the PN routing managing unit **310** notifies the PNEs of completion of PN configuration/registration with reference to the PN routing table as described above.

FIG. **4** is a block diagram of the CPNS server **140**, according to an embodiment of the present invention.

Referring to FIG. **4**, the CPNS server **140** includes a PN managing unit **410**, a memory unit **420**, and a WAN module **430**.

The WAN module **430** communicates with the PN gateway **100** and the service/content provider **150**.

The memory unit **420** stores various services and contents received from the service/content provider **150**.

The PN managing unit **410** controls an overall operation of the CPNS server **140**. When receiving a PN registration request message from the PN gateway **100**, the PN managing unit **410** detects a PN document included in the PN registration request message. The PN managing unit **410** performs CPNS user authentication and authorization on the PNE in the PN document and stores this in the memory unit **420**. If PN ID information is not allocated to the PN included in the PN document, an ID is allocated as the PN ID information. If the PN ID information is already allocated, a redundancy check is performed to determine whether the prestored PN ID information also includes the allocated PN ID information. In this manner, the PN ID information may be allocated by the PN gateway **100** or by the CPNS server **140**. If the PN ID information is allocated by the CPNS server **140**, it does not require a redundancy check.

In order to perform CPNS user authentication and authorization on the PNE in the PN document, the PN managing unit **410** changes the PN document to include an authentication challenge field for each PNE. The PN managing unit **410** extracts target PN ID information from the PN document and generates an authentication request message including the PN ID information. The changed PN document is carried in the authentication request message. However, only the PN ID information is carried in the authentication request message so that the PN gateway **100** can easily search the PN routing table for the addresses of PNEs by detecting only the PN ID information. Accordingly, the PN gateway **100** can detect the addresses of the PNEs mapped to the PN ID information, even without parsing the PN document in the authentication request message to extract the addresses of the PNEs.

Table 4 shows an example of the PN document changed by the CPNS server **140**.

TABLE 4

Personal Network #1 - Identity PN GW Info. PNE #1 <Authentication challenge: nonce=A34Cm+Fva37UYWpGNB34JP, algorithm=AKAv1-MD5, response=?>	
Parameter	Value
Device Info.	
Device Name	Portable Media Player
Network Interface	Bluetooth
Bandwidth	1 Mbps
Storage	2048 MB
I/O Interface	Display, Mic, Speaker
Video Codec	H.264
Audio Codec	AC3
Display Size	6 × 4 inch
Resolution	1024 × 768
Battery	30 W

TABLE 4-continued

Personal Network #1 - Identity PN GW Info. PNE #1 <Authentication challenge: nonce=A34Cm+Fva37UYWpGNB34JP, algorithm=AKAv1-MD5, response=?>	
Parameter	Value
...	...
Content Info.	
Music	Seo Tae-ji Album #8
Movie	Terminator #4
...	...
PNE #2 <Authentication challenge: nonce=A34Cm+Fva37UYWpGNB34JP, algorithm=AKAv1-MD5, response=?> PNE #3 <Authentication challenge: nonce=A34Cm+Fva37UYWpGNB34JP, algorithm=AKAv1-MD5, response=?> ...	

The PN managing unit **410** transmits the authentication request message to the PN gateway **100** and receives an authentication response message from the PN gateway **100**. The PN managing unit **410** completes the authentication of each PNE by determining whether a reply to an authentication challenge field of the authentication response message is identical to its own reply. Thereafter, the PN managing unit **410** generates a registration response message notifying the completion of PN registration, and transmits the registration response message to the PN gateway **100**.

FIG. **5** is a flow diagram illustrating a PN configuration/registration process using a PN routing table, according to a first embodiment of the present invention. In FIG. **5**, the second PNE **120** requests a PN network connection, and the first PNE **110** participates in a PN configuration/registration process at the participation request of the second PNE **120**.

Referring to FIG. **5**, in step **500**, the PN gateway **100** performs an operation for data communication (i.e., a physical pairing operation) by LAN communication with the first PNE **110** and the second PNE **120**.

In step **505**, the second PNE **120** transmits a PN connection request message to the PN gateway **100**. The PN connection request message includes a PN connection type indicator and device information of the second PNE **120**. Specifically, the second PNE **120** may use the PN connection type indicator to select one of a separate connection mode for configuring a PN by itself and an integrated connection mode for configuring a PN in combination with all adjacent PNEs.

When receiving the PN connection request message, the PN gateway **100** determines the PN connection type indicator of the PN connection request message. If the PN connection type indicator indicates the separate connection mode, the PN gateway **100** configures a PN with the second PNE **120** in a PTP scenario. If the PN connection type indicator indicates the integrated connection mode, the PN gateway **100** configures a PN in combination with all adjacent PNEs. When the integrated connection mode is indicated, in step **510**, the PN gateway **100** transmits a PN connection ACKnowledgement (ACK) message to the first PNE **110**, which is one of the adjacent PNEs.

The PN connection request message of step **505** and the PN connection ACK message of step **510** have the same message format. However, the PN connection request message is transmitted from the PNE to the PN gateway **100**, and the PN connection ACK message is used by the PN gateway **100** to make a connection request to the PNE.

If intending to participate in PN configuration, the first PNE **110**, having received the PN connection ACK message, transmits a response message including device information of the first PNE **110** to the PN gateway **100**, in step **515**. If not intending to participate in PN configuration, the first PNE **110** transmits a Non-ACKnowledgement (NACK) message to the PN gateway **100**. When receiving the response message from the first PNE **110**, the PN gateway **100** uses the PN connection request message of the second PNE **120** and the response message of the first PNE **110** to generate a PN routing table in step **520**. Specifically, the PN gateway **100** obtains PNE addresses from the device information of the second PNE **120** in the PN connection request message and the device information of the first PNE **110** in the response message, allocates PN ID information to a PN, and maps the allocated PN ID information to the obtained PNE addresses, thereby generating the PN routing table.

In step **525**, the PN gateway **100** creates a PN document. The PN document includes at least one of a list of PNEs included in a PN and information about the PN including the PNEs (i.e., PN ID information). The device list may include device information of each PNE. The PN document may also include information about contents of each PNE.

In step **530**, the PN gateway **100** generates a PN registration request message including the PN document. In step **530**, the PN gateway **100** transmits the PN registration request message to the CPNS server **140**. The CPNS server **140** detects the PN document included in the PN registration request message. The CPNS server **140** searches target PNEs on the basis of the device information or the device list in the PN document. When the target PNEs are detected, an authentication/authorization operation is performed to authenticate the PNEs as CPNS users. The CPNS server **140** generates an authentication request message for each PNE and transmits the authentication request message to the PN gateway **100** in step **535**. The authentication request message carries a PN document including target PN ID information.

Although the PN ID information has been described as being allocated by the PN gateway **100**, the PN ID information may also be allocated by the CPNS server **140**. Also, IDs may be allocated by the CPNS server **140** to identify the PN gateway **100** and the PNEs.

If the PN ID information is allocated by the PN gateway **100**, the PN ID information is included in the PN document carried in the PN registration request message. Thus, the CPNS server **140** extracts the PN ID information, allocated by the PN gateway **100**, from the PN document, and includes the extracted PN ID information in the authentication request message.

If the PN ID information is not allocated by the PN gateway **100**, the CPNS server **140** allocates PN ID information to target PNEs because it can detect the target PNEs from the device list in the PN document. The CPNS server **140** includes the allocated PN ID information in the authentication request message.

If the PN ID information is allocated by the CPNS server **140**, the PN routing table of step **520** may be generated after obtaining the allocated PN ID information from the CPNS server **140**, and the PN document of step **525** may include only the device list of PNEs.

When receiving the authentication request message from the CPNS server **140**, the PN gateway **100** detects the PN ID information of the authentication request message in step **540**. The PN gateway **100** detects the addresses of the PNEs mapped to the detected PN ID information with reference to the PN routing table. The PN document in the authentication request message is not parsed. In steps **545** and **550**, the PN gateway **100** forwards the authentication request message of the CPNS server **140** to the first and second PNEs **110** and **120** based on the addresses of the PNEs.

When receiving the authentication request message from the PN gateway **100**, each of the first and second PNEs **110** and **120** parses the PN document of the authentication request message. Because the parsing of the PN document is performed by each of the PNEs, the processing load of the PN gateway **100** is reduced. The PN document is parsed to detect an authentication challenge field, and a reply for authentication is obtained with reference to the authentication challenge field. The first and second PNEs **110** and **120** obtain a reply to the authentication challenge field, change the PN document, generate an authentication response message carrying the changed PN document, and transmit the authentication response message to the PN gateway **100**, in steps **555** and **560**.

In step **565**, the PN gateway **100** collects the authentication response messages from the first and second PNEs **110** and **120**. The PN gateway **100** obtains the PN documents from the collected authentication response messages, combines the obtained PN documents into an integrated PN document, and transmits an authentication response message carrying the integrated PN document to the CPNS server **140**, in step **570**. When receiving the authentication response message from the PN gateway **100**, the CPNS server **140** authenticates each PNE on the basis of a reply to the authentication challenge field. If the authentication is successful, the CPNS server **140** transmits a registration response message to notify the completion of PN registration to the PN gateway **100**, in step **575**. In step **580**, the PN gateway **100** generates and transmits an OK message to notify the success of PN configuration/registration to the second PNE **120**. In step **585**, the PN gateway **100** generates and transmits a notification message to notify the success of PN configuration/registration to the first PNE **110**.

FIG. **6** is a flow diagram illustrating a PN configuration/registration process using a PN routing table, according to a second embodiment of the present invention. Steps **600** to **655** and **665** of FIG. **6** are identical to steps **500** to **560** of FIG. **5**, and thus a detailed description of these step in FIG. **6** is provided above with reference to FIG. **5**.

In the first embodiment of the present invention, the PN gateway **100** combines the PN documents of the authentication response messages, received from the first and second PNEs **110** and **120**, into an integrated PN document. However, in the second embodiment of the present invention, the PN gateway **100** separately transmits the authentication response messages, received from the first and second PNEs **110** and **120**, to the CPNS server **140** in steps **660** and **670**. In step **675**, the CPNS server **140** parses the PN documents of the authentication response messages and authenticates the PNEs on the basis of a reply to the authentication challenge field. In step **680**, the CPNS **140** generates an integrated PN document and transmits a registration response message carrying the integrated PN document to the PN gateway **100**. The PN gateway **100** detects the address of each PNE with reference to the PN routing table. Steps **685** and **690** of FIG. **6** are identical to steps **580** and **585** of FIG. **5**. The PN gateway **100** need not generate an integrated PN document in the second embodiment of the present invention, thus reducing the processing load of the PN gateway **100**.

As described above, according to the present invention, the PNE configures a PN with the PN gateway for registration with the CPNS server to provide a CPNS. A PN configuration process of embodiments of the present invention is not a series of operations for simply combining devices into a

group, but is a method for LAN PNEs to receive a service from a WAN through a PN gateway capable of accessing the service provider network.

When receiving a message for authentication from the CPNS server, the present invention detects a target PNE by using a PN routing table, generated by the PN gateway at the PN configuration time, without parsing the PN document, and forwards an authentication message to the target PNE. This makes it possible to reduce the processing load of the PN gateway for processing the PN document for PN registration/authentication.

While the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A method for configuring a Personal Network (PN) by a PN gateway comprising the steps of:

receiving a connection request message from a Personal Network Entity (PNE);

determining a PN connection mode included in the connection request message;

if the connection mode involves participation of all PNEs, transmitting the connection request message to other PNEs, and receiving a connection response message allowing PN participation from the other PNEs, in response to the connection request message;

establishing the PN with one or more PNEs at the PN gateway in accordance with the connection mode;

generating a PN routing table in which information about the one or more PNEs is mapped to IDentification (ID) information of the PN;

receiving an authentication request message including the ID information of the PN at the PN gateway from a server; and

forwarding the authentication request message from the PN gateway to one or more PNEs identified with the ID information of the PN, with reference to the PN routing table;

wherein the one or more PNEs receive a service from the server through the PN gateway.

2. The method of claim **1**, further comprising obtaining the information about the one or more PNEs, which is included in a message requesting PN establishment received from the one or more PNEs.

3. The method of claim **1**, further comprising:

allocating ID information of the PN including the one or more PNEs; and

storing the PN routing table.

4. The method of claim **1**, wherein the information about the one or more PNEs comprises PNE address information.

5. The method of claim **1**, further comprising:

generating a PN document including at least one of the information about the one or more PNEs and the ID information of the PN; and

generating a registration request message carrying the PN document; and

transmitting the registration request message to the server.

6. The method of claim **5**, wherein the information about the one or more PNEs includes a device list of the one or more PNEs.

7. The method of claim **1**, further comprising transmitting an authentication response message to the server when the authentication response message is received from the one or more PNEs.

8. The method of claim **1**, further comprising:

collecting at least one authentication response message received from each of the one or more PNEs;

combining PN documents into an integrated PN document, wherein each PN document is carried in a respective authentication response message and includes information about a respective PNE and ID information of the PN; and

transmitting a secondary authentication response message carrying the integrated PN document to the server.

9. The method of claim **5**, further comprising:

receiving a registration response message from the server; and

transmitting one or more messages notifying the one or more PNEs of completion of registration of the PN with reference to the PN routing table.

10. A method for configuring a Personal Network (PN) by a server located in a wide area network (WAN), comprising the steps of:

receiving a request message for establishing the PN, to which one or more Personal Network Entities (PNEs) belong, at the server from a PN gateway;

transmitting an authentication request message including IDentification (ID) information of the PN for authentication of the one or more PNEs from the server to the PN gateway;

receiving an authentication response message from the PN gateway that forwards the authentication request message to the one or more PNEs identified using the ID information of the PN in a PN routing table;

authenticating the one or more PNEs by comparing a reply of the server with a reply to an authentication challenge field included in the authentication response message;

registering the PN when the one or more PNEs are authenticated;

generating a PN document in response to the authentication of the one or more PNEs; and

transmitting a response message carrying the generated PN document for establishing the PN to the PN gateway;

wherein the one or more PNEs receive a service from the server through the PN gateway.

11. The method of claim **10**, wherein the request message carries a PN document including at least one of information about the one or more PNEs and ID information of the PN.

12. The method of claim **11**, further comprising:

detecting the one or more PNEs as authentication targets based on the information about the one or more PNEs in the PN document;

generating the authentication request message including the authentication challenge field for authenticating the detected one or more PNEs; and

carrying the PN document, including the ID information of the PN, in the authentication request message.

13. The method of claim **10**, further comprising:

allocating ID information of the PN including the one or more PNEs; and

including the allocated ID information of the PN in the authentication request message.

14. A Personal Network (PN) gateway for configuring a PN, comprising:

a first interface unit configured to communicate with one or more Personal Network Entities (PNEs);

a second interface unit configured to communicate with a server located in a WAN;

a controller configured to receive a connection request message from a PNE, determine a PN connection mode included in the connection request message, transmit the

connection request message to other PNEs and receive a connection response message allowing PN participation from the other PNEs in response to the connection request message if the connection mode involves participation of all PNEs, establish a PN with the one or more PNEs in accordance with the connection request message, generate a PN routing table in which information about the one or more PNEs is mapped to IDentification (ID) information of the PN, receive an authentication request message including the ID information of the PN from a server, and forward the authentication request message to one or more PNEs identified with the ID information of the PN, with reference to the PN routing table; and

a memory unit storing the PN routing table,

wherein the one or more PNEs receive a service from the server through the PN gateway.

15. The PN gateway of claim **14**, wherein the controller obtains the information about the one or more PNEs included in a message requesting PN establishment received from the one or more PNEs, allocates the ID information of the PN including the one or more PNEs, and stores the PN routing table in the memory unit.

16. The PN gateway of claim **14**, wherein the controller collects an authentication response message when the authentication response message is received from each of the one or more PNEs, combines PN documents into an integrated PN document and transmits a secondary authentication response message carrying the integrated PN document to the server, wherein each PN document is carried in a respective authentication response message and includes information about a respective PNE and ID information of the PN.

17. A server located in a Wide Area Network (WAN) for configuring a Personal Network (PN), comprising:

an interface unit configured to communicate with a PN gateway; and

a controller configured to transmit an authentication request message including IDentification (ID) information of a PN for authentication of one or more Personal Network Entities (PNEs) upon receiving a request message for establishing the PN, to which the one or more PNEs belong, from the PN gateway, receive an authentication response message from the PN gateway that forwards the authentication request message to the one or more PNEs identified using the ID information of the PN in a PN routing table, authenticate the one or more PNEs by comparing a reply of the server with a reply to an authentication challenge field included in the authentication response message, register the PN when the one or more PNEs are authenticated, generate a PN document in response to the authentication of the one or more PNEs, and transmit a response message carrying the generated PN document for establishing the PN to the PN gateway,

wherein the one or more PNEs receive a service from the server through the PN gateway.

18. The server of claim **17**, wherein the controller detects the one or more PNEs as authentication targets based on the information about the one or more PNEs and the ID information of the PN included in a PN document carried in the request message, generates the authentication request message; and transmits the authentication request message including the ID information of the PN.

19. A method for configuring a Personal Network (PN) by a PN gateway comprising the steps of:

establishing the PN with one or more Personal Network Entities (PNEs) at the PN gateway;

generating a PN routing table in which information about the one or more PNEs is mapped to IDentification (ID) information of the PN;

receiving an authentication request message including the ID information of the PN at the PN gateway from a server;

identifying the information about the one or more PNEs from the PN routing table using the ID information of the PN received in the authentication request message;

forwarding the authentication request message from the PN gateway to the one or more PNEs using the information about the one or more PNEs identified from the routine table;

collecting at least one authentication response message received from each of the one or more PNEs;

combining PN documents into an integrated PN document, wherein each PN document is carried in a respective authentication response message and includes information about a respective PNE and ID information of the PN; and

transmitting a secondary authentication response message carrying the integrated PN document to the server;

wherein the one or more PNEs receive a service from the server through the PN gateway.

20. A method for configuring a Personal Network (PN) by a server located in a wide area network (WAN), comprising the steps of:

receiving a request message for establishing the PN, to which one or more Personal Network Entities (PNEs) belong, at the server from a PN gateway;

transmitting an authentication request message including IDentification (ID) information of the PN for authentication of the one or more PNEs from the server to the PN gateway;

receiving an authentication response message from the PN gateway that forwards the authentication request message to one or more PNEs using information about the one or more PNEs identified from a PN routing table using the ID information of the PN;

registering the PN in response to the received authentication response message;

generating a PN document in response to the authentication of the one or more PNEs; and

transmitting a response message carrying the generated PN document for establishing the PN to the PN gateway;

wherein the one or more PNEs receive a service from the server through the PN gateway.

21. A Personal Network (PN) gateway for configuring a PN, comprising:

a first interface unit configured to communicate with one or more Personal Network Entities (PNEs);

a second interface unit configured to communicate with a server located in a WAN;

a controller configured to establish a PN with the one or more PNEs, generate a PN routing table in which information about the one or more PNEs is mapped to IDentification (ID) information of the PN, receive an authentication request message including the ID information of the PN from a server, identify the information about the one or more PNEs from the PN routing table using the ID information of the PN received in the authentication request message, forward the authentication request message to one or more PNEs using the information about the one or more PNEs identified from the PN routing table, collect at least one authentication response message received from each of the one or more PNEs, combine PN documents into an integrated PN docu-

ment, wherein each PN document is carried in a respective authentication response message and includes information about a respective PNE and ID information of the PN, and transmit a secondary authentication response message carrying the integrated PN document to the server; and

a memory unit storing the PN routing table,

wherein the one or more PNEs receive a service from the server through the PN gateway.

22. A server located in a Wide Area Network (WAN) for configuring a Personal Network (PN), comprising:

an interface unit configured to communicate with a PN gateway; and

a controller configured to transmit an authentication request message including IDentification (ID) information of a PN for authentication of one or more Personal Network Entities (PNEs) upon receiving a request message for establishing the PN, to which the one or more PNEs belong, from the PN gateway, receive an authentication response message from the PN gateway that forwards the authentication request message to one or more PNEs using information about the one or more PNEs identified from a PN routing table using the ID information of the PN, register the PN in response to the authentication response message, generate a PN document in response to the authentication of the one or more PNEs, and transmit a response message carrying the generated PN document for establishing the PN to the PN gateway,

wherein the one or more PNEs receive a service from the server through the PN gateway.

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